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The Production of Scallop Seed

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by

T. Tanaka, A. Sato, K. Kawamura

This year, the spawning scallops we used were mother shells collected from 3 sites in the Mutsu Bay. The spawning induction results were unsatisfactory. For rearing the larvae we tested the running water instead of the still water system adopted so far. The purpose was to achieve a reduction of labor as well as high-density rearing. This time, we examined flow rates to see whether it was possible to rear larvae in running water.

1. Scallop mother shells and spawning induction

Materials and method

The mother shells used had been sown in Kawauchi, Shimokita Township (age unknown) or cultured by the suspending method in Okunai, Aomori City and in Urada, Higashitsugaru Township (2-3 years of age). The collected scallops were taken to our place and placed in 30 L fish boxes through which we ran filtered water. Some of the mother shells were used for gonad measurements.

Spawning was induced by running warmed seawater (5°C ~ 15°C).

Results

Table 1 shows the state of spawning induction and the gonad

indices. Spawning induction was carried out 11 times from March 5 to April 4. Six of the attempts produced a response. There was only one joint response from females and males. Moreover, on March 5, only one of the 4 responding females performed normal spawning. The average values of the gonad index exceeded 25% only among the shells cultivated by the suspending method in Okunai and collected on March 12. Among the shells sown in Kawauchi, the average value measured on March 7 was as low as 13.5% and the gonad index range was 20 ~ 6%. p. 48

2. Rearing of the larvae

a) Continuously running water rearing

Material and method

We used larvae swimming at the surface after being spawned March 9. The rearing containers were made by cutting out the bottoms of 20 I polyethylene buckets and covering these bottoms with a net (mesh size 40 μ). The containers were placed in a tank so as to hold 15 L of seawater. Running water was made to drop in the buckets used for rearing. The respective flow rates were 0.75 L/min, 0.28 L/min, 0.18 L/min, 0.11 L/min. In order to examine the appropriate volume of running rearing water, the rearing density was kept constant at 1.200 individuals/L. For feeding, we gave 3.000 ~ 20.000 Monochrysis lutheri cells per 1 mL of rearing water once a day. We kept the water running during and after the feeding.

Results

Table 2 shows the growth and survival rates per volume of running water. It shows that a better larval growth is reached with a smaller water flow. A comparison of the survival rates 8 days after fecundation indicates 25% and 20% with 0.75 L/min and 0.28 L/min

respectively but 50% with 0.18 L/min and 75% with 0.11 L/min. While the three first groups showed 0% after 10 days, the 0.11 L/min group showed 7.5%. When the inside of the rearing containers were lit on the 18th day with a flashlight, only a few larvae remained. However on the 34th day we noted juvenile shells with an average size of 325 μ attached to the walls of the containers.

Nevertheless, as the larval growth was slow and as a fair amount of feed was suspected to escape from the containers, we put 15 L of seawater in buckets whose bottoms had been covered with myurā* gauze and placed these buckets in the tank. As with the rearing of the larvae, we dropped seawater in the containers at the rate of 0.75 L/min. Table 3 shows the volumes of feed organisms (Monochrysis lutheri) escaping from the buckets. From the table, we see that 15 min after feeding in running water, 73.1% of the feed has escaped and that most of the feed has disappeared after 1 hour. In still water on the other hand, about 50% of the feed remained in the containers after 4 hours.

b) Rearing in intermittently running water p. 49

As we explained in a), most of the feed is lost with constant running water. As almost no feed seemed to be used by the larvae, we adopted the still water system for the rearing water during and after feeding.

Materials and Method

The larvae used for rearing had been reared by the traditional still water method in perlite tanks. Their average shell length was

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* Translator's note: as transliterated; meaning uncertain; probably some synthetic fiber.

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170 μ (130 - 195 μ range). The rearing containers were the same as in a). The larvae were accommodated at the rate of 1.300 individuals/L. Taking into consideration the outflow of feed, we gave a volume practically double of that provided in the still water system. The water flow was stopped from feeding time (3:30 ~ 4:30 PM) to the next morning (8:30 ~ 9:00 A.M.). Thereafter the water was allowed to run. We adopted two flow rates, viz. 0.75 L/min and a very gentle drip.

Results

The results are shown in Table 4. The larval survival rate was higher with the gentle drip. On the 22nd day following fecundation, the survival rate was 46% and on the 24th day we noted that spat had attached themselves to the walls of the buckets. With water running at the rate of 0.75 L/min, the survival rate was 21% on the 18th day, and very few larvae were seen on the 22nd day.

Possibly because the feed had been utilized by the larvae, there was no difference in growth depending on the water flow as in a). On the 34th day, the average shell length was 419 μ with a 320 - 600 μ range.

3. Discussion

This year, the scallop gonad index was lower than usual and there were fewer responses to spawning induction. In order to collect artificial seed indoors the whole year through, one must improve the method of keeping mother shells artificially, the method of cultivating mother shells in natural sea areas and reexamine the method of rearing spawning mother shells.

This year, we tried to rear larvae in running water. By rearing in running water, we hoped not to have to change the water and tried to reduce the work. We also aimed at raising the density of larvae accommodated per unit of rearing water. However, our only achievement was to examine the flow rates during rearing time. In a) we tested 4 flow rates. A gentle flow was best for larval growth. The probable reason is the volume of feed ingested by the larvae. Possibly because the feed outflow was small when the water was stopped in b) at feeding time, there was almost no difference in larval growth. There was, however, a difference in survival rate. The decrease in survival rate may be due to the effect of water turbulence upon the larvae. Further research seems necessary. Because of all these reasons, there seems to be a suited flow rate to keep when rearing larvae in running water. With an accommodation density similar to that adopted for still water rearing, the larvae reach the attachment stage. With regard to the feeding method, one may choose a method in which the feed does not flow out of the rearing water or increase the dosage making allowance for the escaping feed.

There are still some unanswered questions regarding the density which is allowable per unit of rearing water when rearing larvae in running water. When raising French oysters in running water, we obtained an 8% survival rate after 14 rearing days (50 individuals/mL) and some spat were seen to attach themselves.

Thus larvae reach the attachment stage, even in running water. However, many points such as the feeding method require further study.

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Table 1 Scallop spawning induction

a 誘発年月日	b 採捕月日	c 採捕場所	d 年令	e 養殖方法	f 放卵放精個体数		g 生殖巣指数		
					h 雄	i 雌	j 最大	k 最小	l 平均
**48. 3. 5	3. 5	奥m内	45年産貝	o垂下養殖貝	0	0	28	10	19.5
48. 3. 8	3. 7	川n内	年令不詳	p地蒔貝	0	0	21	12	16.0
48. 3. 8	3. 7	川n内	46年産貝	o垂下養殖貝	0	0	20	6	13.5
48. 3. 8	3. 8	奥m内	45年産貝	o垂下養殖貝	0	0	—	—	—
48. 3. 9	3. 7	川n内	年令不詳	p地蒔貝	0	0	—	—	—
48. 3. 9	3. 9	浦q田	45年産貝	o垂下養殖貝	18	*4	33	13	21.2
48. 3. 12	3. 12	奥m内	45年産貝	o垂下養殖貝	0	0	32	16	25.0
48. 3. 12	3. 12	奥m内	46年産貝	o垂下養殖貝	0	0	35	20	26.4
48. 3. 15	3. 15	川n内	年令不詳	p地蒔貝	3	0	—	—	—
18 3 16	3. 16	浦q田	45年産貝	o垂下養殖貝	6	0	—	—	—
18. 3 17	3. 16	浦q田	45年産貝	o垂下養殖貝	0	0	—	—	—
48. 3 23	3. 23	川n内	年令不詳	p地蒔貝	2	0	—	—	—
48. 3. 26	3. 26	浦q田	46年産貝	o垂下養殖貝	0	0	37	15	24.0
48. 3. 31	3. 29	川n内	年令不詳	p地蒔貝	3	0	29	15	21.6
48 4. 4	4. 4	川n内	年令不詳	p地蒔貝	1	0	26	11	19.9

Key:
- a induction date
- b collection date
- c collection site
- d years
- e cultivation method
- f number of spawning or spermatizing individuals
- g gonad index
- h male
- i female
- j largest
- k smallest
- l average
- m Okunai
- n Kawauchi
- o suspended cultivation
- p sowing
- q Urada

* One of 4 females could be used

** 48 = 1973
45 = 1970
46 = 1971

Table 2 Growth and survival rates by volume of running water

a 受精後の日数	b 流水量											
	c 0.75 ℓ/分			0.28 ℓ/分 c			0.18 ℓ/分 c			0.11 ℓ/分 c		
	d 1) 殻長	e 殻長範囲	f 生残率 2)	d 殻長	e 殻長範囲	f 生残率	d 殻長	e 殻長範囲	f 生残率	d 殻長	e 殻長範囲	f 生残率
4	127	110 − 140	100	127	110 − 140	100	127	110 − 140	100	127	110 − 140	100
8	128	120 − 135	25	132	130 − 140	20	134	120 − 140	50	138	130 − 145	75
10			0			0			0	135	120 − 150	75
12										145	130 − 150	67
14										149	140 − 160	58
16										155	130 − 165	33
18												+3)
20												+
26										210	180 − 235	+
34										325	260 − 440	+

Key: a number of days after fecundation
b running water volume
c min
d shell length
e shell length range
f survival rate

Note: 1) shell length : μ
2) survival rate : %
3) only a few

Table 3 Correlation between time elapsed and the outflow of feed organisms

a 1) 経過時間	b 流水量	
	c 0.75 ℓ/分	d 止水
0	0 2)	0
15	73.1	38.1
30	85.1	39.0
60	98.1	38.1
120	−	42.9
180	−	47.6
240	−	52.4

Key: a time lapsed
b running water volume
c 0.75 L/min.
d still water

Note: 1) min
2) %

Table 4 Growth and survival rates per volume of running water

受精後の日数 a	流水量 b					
	c ポタポタと落ちる程度			d 0.75 ℓ/分		
	殻長 e 1)	殻長範囲 f	生残率 g 2)	殻長 e	殻長範囲 f	生残率 g
12	170	130 − 195	100	170	130 − 195	100
14	182	160 − 210	100	186	170 − 200	73
16	192	175 − 230	100	186	170 − 205	31
18	200	175 − 230	77	199	180 − 210	21
20	204	170 − 230	69			
22	210	185 − 240	46			+
24			− 3)			
26	225	180 − 240	−	206	180 − 220	+
34	419	320 − 600	−			

Key: a number of days after fecundation
b volume of running water
c drip d 0.75 L/min.
e shell length
f shell length range
g survival rate

Notes: 1) shell length : μ
2) survival rate : %
3) shells attached